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EXAMINER	
POLYZOS, FAYE S	

ART UNIT	PAPER NUMBER
2884	

DATE MAILED: 02/22/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/769,217	DEL GRANDE, NANCY K.	
	Examiner	Art Unit	
	Faye Polyzos	2884	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8 and 13-25* is/are rejected.

7)☒ Claim(s) *9-12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Claim 1 recites the limitation "computing the twice-daily and bi-yearly temperature spreads of the host and the object site;" in lines 9-10 in the claim. There is insufficient antecedent basis for this limitation in the claim.

2. Claims 5-6 and 13 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The term "surface-climate energy budget (SCEB) code" is not clearly defined in the Specifications on how to apply a (SCEB) code to detect subsurface objects.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-4, 7-8 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Prelat et al (US 5,445,453 A)* in view of Torgersen et al ("Airborne thermal remote sensing for water temperature assessment in rivers and streams") and *Sunlin et al (US 5,900,833 A).*

Regarding claim 1, Prelat disclose a method for remotely sensing subsurface objects and structures, comprising: (a) selecting a host and a subsurface object site

environment, wherein the host and the subsurface object site environment are naturally heated (i.e. solar heating cycle); (b) surveying the host and the object site by: (c) simulating the temperature of the host and the object site; calculating the thermal inertias of the host and the object site; and computing the twice daily and bi-yearly temperatures spreads of the host and object site (i.e. heat flow patterns calculated during 24-hour thermal cycle) (col. 1, lines 46-51); (f) scanning the host and the object site at different times with two different IR wavelengths and recording (34) a spatial sequence of dual-band IR images (col. 2, lines 6-34); (g) calculating (using image processing code) signal ratio and differences to form temperature, emissivity-ratio (col. 3, lines 6-14). Prelat does not specifically disclose of (d) changing the environment of the host and the object site if the temperature spread of the object site is not distinguishable from that of the host; (h) co-register, corrected-temperature and twice-yearly or twice daily temperature-spread maps with the corrected-temperature maps; (i) correcting the temperature maps and temperature-spread maps; (j) removing foreign object thermal clutter from temperature-spread maps; (k) determine location, size and shape of temperature maps; (l) determine object, thickness, volume, and depth information from temperature-spread maps; and (m) provide a 3-D display of the object. Torgersen discloses (d) changing the environment of the host and the object site if the temperature spread of the object site is not distinguishable from that of the host; (h) co-register, corrected-temperature and twice-yearly or twice daily temperature-spread maps with the corrected-temperature maps; (i) correcting the temperature maps and temperature-spread maps (page 394, col. 1, paragraph 3); (j) removing foreign object

thermal clutter from temperature-spread maps; (k) determine location, size and shape of temperature maps (page 389, section 2.5); (l) determine object, thickness, volume, and depth information from temperature-spread maps (page 387, section 2.1, paragraph 1 and page 389, col. 1, paragraph 3). Torgersen teaches after taking into account the radiative properties of the surrounding environment and the physical qualities of the stream, thermal remote sensing proved highly effective for examining spatial patterns of stream temperature at a resolution and extend previously unattainable through conventional methods of stream temperature measurement using in-stream data recorders (See Abstract). Sunlin discloses a method for remotely sensing subsurface objects and structures, comprising: (m) provide a 3-D display of the object. Sunlin teaches the combination of real and synthetic aperture beam processing results in very high antenna array gain and narrow beam widths, improving capabilities of deeper penetration into the material, higher resolution, and improved rejection of ground clutter. The result is a three dimensional image of the underground target area. The processed output may be viewed on a display which uses color to permit a visualization of the three-dimensional image. Therefore it would have been obvious to modify the method suggested by Prelat, to include steps (d) and (h)-(m), as suggested by Torgersen and Sunlin, to allow for a more versatile method to remotely sense subsurface objects.

Regarding claim 2, Torgersen disclose the method wherein the host and the subsurface object site environment are located from data selected from the group consisting of aerial photos, satellite imagery and site maps that include information selected from the group consisting of surface conditions, soil type, vegetation, geology,

meteorology and topography (See Generally Fig. 1 and pg. 387, col. 1 and paragraph 3).

Regarding claim 3, Torgersen discloses the method wherein the host is selected from the group consisting of rock, pavement, concrete, gravel, sand, soil, mud, water (See Generally Fig. 1 and pg. 387, section 2.1).

Regarding claim 4, Torgersen discloses the method wherein the object thermal clutter is selected from the group consisting of a shadow, a track, a stain disturbed terrain, a hole, vegetation, a foreign object, foreign material, foreign soil, water, cool air pools and roughness variations (pg. 389, col. 1, paragraph 1).

Regarding claim 7, Torgersen discloses the method wherein surface clutter is eliminated by separating temperature data from spatially-varying surface-emissivity data, to obtain true, time-varying temperature-difference values at scanned points of the object area, from a plurality of points in space and time (pg. 387, col. 1, section 2.1).

Regarding claim 8, Torgersen discloses the method wherein subsurface clutter is eliminated by separating thermal inertia data for normal, undisturbed host and targeted-object materials, from anomalous thermal inertia data for disturbed host or foreign-object materials, characterize by their depths, volumes and physical features, unlike the targeted object and host material, to obtain true, spatially varying thermal-inertia differences which characterize the subsurface targeted object site, from a plurality of points in space and time (pg. 387, section 2.1, pg. 388, section 2.3 and pg. 389, section 2.5).

Regarding claim 14, Torgersen discloses the method wherein the images in the sequence are typically taken at midday (near noon), and after midnight (before dawn), to detect shallow objects (pg. 388, section 2.3).

Regarding claim 15, Torgersen discloses the method wherein the images in the sequence are typically taken during the autumn (September or October), and during spring (March or April), to detect deep objects (pg. 388, section 2.3).

Regarding claim 16, Torgersen discloses the method wherein the scanning is performed with at least the same number of detectors as the number of scanned wavelengths (pg. 387, section 2.2).

Regarding claim 17, Torgersen discloses the method wherein the scanning occurs for at least two different infrared wavelength bands comprising a long wavelength band ranging from 8-12 micrometers and a short wavelength band ranging from 3-5 micrometers (pg. 387, section 2).

Regarding claim 18, Torgersen discloses the method wherein the subsurface objects are selected from the group consisting of hollow, or semi-empty objects and structures which typically have less thermal inertia (resistance to temperature change) than their surroundings of undisturbed earth (pg. 389, section 2.5).

Regarding claim 19, Torgersen discloses the method wherein the subsurface objects are selected from the group consisting of solid, or semi-solid objects and structures which have more thermal inertia (resistance to temperature change) than their surrounding host material (pg. 389, section 2.5).

Regarding claim 20, Prelat disclose a thermal imaging method to detect subsurface objects or air gaps, comprising: imaging two different infrared (IR) wavelength bands a first time from a first location and a second location to obtain a first temperature map; imaging the two different IR wavelength bands a second time from the first location and the second location to obtain a second temperature map; combining the first temperature map and the second temperature map to obtain a first temperature spread at the first location and a second temperature spread at the second location (col. 2, lines 6-15, col. 3, lines 6-45). Prelat does not specifically disclose comparing the temperature spread to determine the whether the object is located beneath the first location or the second location. Torgersen discloses a thermal imaging method to detect subsurface objects, wherein after combining first and second temperature maps to obtain temperature spreads, comprising; comparing the first temperature spread with the second temperature spread to determine the location of the object or structure according to the first and second locations (See Generally Fig. 1 and pg. 387, section 2.1, pg. 388, section 2.3 and pg. 389, section 2.5). Torgersen teaches after taking into account the radiative properties of the surrounding environment and the physical qualities of the stream, thermal remote sensing proved highly effective for examining spatial patterns of stream temperature at a resolution and extend previously unattainable through conventional methods of stream temperature measurement using in-stream data recorders (See Abstract). Therefore it would have been obvious to modify the method suggested by Prelat, to include comparison of the temperature

spreads, as suggested by Torgersen, to allow for a more versatile method to determine the location of an object or structure.

5. Claims 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Prelat et al (US 5,445,453 A),* Torgersen et al ("Airborne thermal remote sensing for water temperature assessment in rivers and streams") and *Sunlin et al (US 5,900,833 A)* as applied to claim 1 above, and further in view of *Nunnally et al (US 5,936,233 A).*

Regarding claims 21-25, Prelat disclose a method for remotely sensing subsurface objects and structures, comprising: (a) selecting a host and a subsurface object site environment, wherein the host and the subsurface object site environment are naturally heated (i.e. solar heating cycle); (b) surveying the host and the object site by: (c) simulating the temperature of the host and the object site; calculating the thermal inertias of the host and the object site; and computing the twice daily and bi-yearly temperatures spreads of the host and object site (i.e. heat flow patterns calculated during 24-hour thermal cycle) (col. 1, lines 46-51); (f) scanning the host and the object site at different times with two different IR wavelengths and recording (34) a spatial sequence of dual-band IR images (col. 2, lines 6-34); (g) calculating (using image processing code) signal ratio and differences to form temperature, emissivity-ratio (col. 3, lines 6-14). Torgersen discloses (d) changing the environment of the host and the object site if the temperature spread of the object site is not distinguishable from that of the host; (h) co-register, corrected-temperature and twice-yearly or twice daily temperature-spread maps with the corrected-temperature maps; (i) correcting the temperature maps and temperature-spread maps (page 394, col. 1, paragraph 3); (j)

removing foreign object thermal clutter from temperature-spread maps; (k) determine location, size and shape of temperature maps (page 389, section 2.5); (l) determine object, thickness, volume, and depth information from temperature-spread maps (page 387, section 2.1, paragraph 1 and page 389, col. 1, paragraph 3). Sunlin discloses a method for remotely sensing subsurface objects and structures, comprising: (m) provide a 3-D display of the object. Prelat, Torgersen nor Sunlin specifically disclose of subsurface objects and structures comprise a fault I the structure. Nunnally discloses a method wherein the subsurface objects and structures comprise a fault located in a structure selected from the group consisting of a bridge deck, a pipe, a sewer, a retaining wall, a building structure and a semiconductor chip (col. 2, lines 57-65). Nunnally teaches the system functions to remotely sense under the surface of the earth to detect the location of buried objects (i.e. pipelines, electrical utilities, land mines, unexploded ordinance, mineral and carbon-based fuel deposits, archaeological remains, voids, cavities and tunnels). Therefore, it would have been obvious to modify the method suggested by Prelate, Torgersen and Sunlin, to include a method for fault location, as disclosed supra by Nunnally, to allow for a more versatile method of detecting subsurface objects.

Allowable Subject Matter

6. Claims 9-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Regarding dependent claim 9, the prior art, does not disclose or fairly suggest a method wherein separating surface temperature data from spatially-varying surface emissivity data is achieved by using the following temperature ratio equation to obtain a temperature map:

$[SWB/LWB]=[(\varepsilon_5/\varepsilon_{10})(T/T_o)^5]$;

$(T/T_o)^5=(S/S_{av})/(L/L_{av})$

Regarding dependent claim 10, the prior art, does not disclose or fairly suggest a method wherein separating surface temperature data from spatially-varying surface emissivity data is further achieved by using the following emissivity-ratio equation to obtain an emissivity ratio map:

$[(LWB)^2/(SWB)]= (\varepsilon_{10})^2 ((\varepsilon_5) = \varepsilon$;

E-ratio $= (L/L_{av})^2 / (S/S_{av})$;

Regarding dependent claim 11, the prior art, does not disclose or fairly suggest a method wherein determining whether an object exists in the host material, comprises comparing the temperature map, with the emissivity-ratio map, to remove unrelated emissivity or reflected signals, forming clutter.

Regarding dependent claim 12, the prior art, does not disclose or fairly suggest a method wherein diurnal or seasonal temperature spread, for corrected temperature maps, is used to distinguish bulk thermal properties of the object within the host material, from bulk thermal properties of an equal volume of the host material.

Conclusion

7. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Faye Polyzos whose telephone number is 571-272-2447. The examiner can normally be reached on Monday thru Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Porta can be reached on 571-272-2444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

9. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

FP

OTILIA GABOR
PRIMARY EXAMINER